Scheduling a single machine with release dates, due dates and family setup times

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In machining environments the combined goal of efficient and effective production may lead to complex control problems. Efficient production in such an environment is translated in minimizing the loss of capacity due to setups and therefore combining jobs with similar setup characteristics. Effective production in an order-driven environment is translated in completing jobs in time, or at least minimizing tardiness. Clearly, these two objectives may be conflicting: clustering jobs with similar setup characteristics may lead to a severe delay of other "badly fitting" jobs, thereby causing a substantial job tardiness. On the other hand, an "earliest due date" schedule may lead to too many setups, hence a capacity overload and more and more late orders, contrary to its objective. Any solution to this problem should be based on a combination of batching and sequencing procedures.

We present a branch and bound algorithm for the single machine scheduling problem where job processing is subject to both technical (setup characteristics) as well as logistic constraints (release and due dates). The objective is to minimize the maximum lateness. A lower bound is presented for the lateness of a set of jobs in an optimal schedule. A tabu search algorithm in combination with a cheapest insertion algorithm provides an upper bound to be used in the branch and bound algorithm. Several side results are developed to speed up the fathoming of subsets of solutions in the algorithm. Test results are presented for up to 40 jobs.

H. Dyckhoff et al., *Operations Research Proceedings 1993*